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last twelve months has been plainly apparent, and the smoke cloud which obscures the London atmosphere appears to be progressively lightening. Mr. Ernest Hart, Chairman of the Smoke Abatement Exhibition in London, frequently pointed out that the greatest contributors to the smoke cloud of London were the small grates of the enormous number of houses of the poor, and a great deal of ingenuity had been exhausted with relatively little success in endeavoring to abate this nuisance. The use of gas fires was urgently recommended, but had hitherto been difficult, owing to its cost and the want of suitable apparatus. The rapid and very extensive growth of the use of gas for cooking as well as lighting purposes by the working classes, due to the introduction of the 'penny in the slot' system, is working a great revolution in the London atmosphere. During the last four years the South London Gas Company alone has fixed 50,000 slot meters and nearly 38,000 small gas cooking stoves in the houses of the workingman.

#### UNIVERSITY AND EDUCATIONAL NEWS.

THE faculty of Cornell University has resolved that, in place of the degree of Master of Arts, Master of Philosophy, Master of Letters and Doctor of Sciences, the one degree of Master of Arts be conferred; and that in place of the degree of Doctor of Philosophy and Doctor of Sciences, the one degree of Doctor of Philosophy be conferred.

PROF. COLLIER COBB contributes to *Appletons' Popular Science Monthly* for October an interesting article in which he calls attention to the modern plan of instruction in the sciences offered by the University of North Carolina more than one hundred years ago. The course planned in 1792 gave great prominence to scientific studies, especially those which could be applied to the arts. The report of the committee recommended the purchase of apparatus for experimental philosophy and astronomy, in which must be included a set of globes, barometer, thermometer, microscope, telescope, quadrant, prismatic glass, electrical machine and an air-pump. The ancient classics were made elective, the degree of B. of A. being obtainable without the study of either Latin or Greek.

DR. D. K. PEARSONS, who had promised \$10,000 to the trustees of the Mount Holyoke Association, has agreed to give them \$40,000 for the building fund.

*Garden and Forest* states that the name of the donor of the new range of greenhouses recently completed for the department of botany of Smith College has up to the present not been announced. Last week, however, a bronze tablet placed at the entrance of the Palmhouse bears this inscription: 'The Lyman Plant House. A Memorial Tribute to Anne Jean Lyman, by her Son, Edward Hutchinson Robbins Lyman.'

It is proposed to create a chair of biology in the University of Christiania, to be filled by Mr. Nansen.

A NUMBER of promotions and new appointments have been made at the Massachusetts Institute of Technology. Four associate professors have been advanced to full professorships. Dwight Porter, in Hydraulic Engineering; Alfred E. Burton, in Topographical Engineering; C. F. Allen, in Railroad Engineering, and Peter Schwamb, in Mechanism. Linus Faunce has been appointed Associate Professor of Drawing. Four new assistant professors have been appointed: George H. Barton, in Geology; William H. Lawrence, in Architecture; George G. Robbins, in Civil Engineering, and Joseph J. Skinner, in Mathematics. Seven assistants have been raised to the rank of instructors. They are William J. Drisko, in Physics; George B. Haven, in Mechanical Engineering; Frank P. McKibben, in Civil Engineering; Alexander W. Moseley, in Mechanical Engineering; James F. Norris, in Organic Chemistry; Joseph W. Phelan, in General Chemistry, and Samuel C. Prescott, in Biology, and in addition A. W. Weyssse has been made Instructor in Biology. Fourteen new assistants have been appointed, as follows: In Civil Engineering, Reuben E. Bakenhus, Minor S. Jameson, Charles M. Spofford and Harold C. Stevens; in Geology, Amadeus W. Grabau; in Industrial Chemistry, Leonard W. Goodhue and Harrison W. Hayward; in Mechanical Drawing, Albert J. Wells; in Mechanical Engineering, Edward M. Bragg and Frank B. Masters; in Oil and Gas Analysis,

William L. Root; and in Physics, George K. Burgess, William D. Coolidge and Ralph R. Lawrence.

DR. E. LESSER has been appointed associate professor of dermatology at Berlin and Dr. Chermak to the chair of comparative anatomy and embryology at Dorpat. Dr. Winkler, professor of chemistry, has been appointed director of the School of Mines at Freiberg i. S., and Dr. Godschmidt has been promoted to an assistant professorship of chemistry in the University of Heidelberg.

#### DISCUSSION AND CORRESPONDENCE.

##### THE STRAIGHT LINE AS A MINIMUM LENGTH.

TO THE EDITOR OF SCIENCE: In looking over the beautiful new text-book of geometry by Profs. Phillips and Fisher one meets with the following proposition of spherical geometry:

*The shortest line that can be drawn on the surface of a sphere between two points is the arc of a great circle, not greater than a semi-circumference, joining these points.*

The demonstration given is one which has been given before. It appears, for example, in the treatise of Chauvenet (1869) and also in that of George Bruce Halsted (1885). In connection with this demonstration, the reader can hardly escape noticing that every step of it applies equally well to plane geometry. In fact, it is perfectly easy for any student of Euclid's Elements to construct, step by step, a precisely similar proof of the corresponding proposition of plane geometry:

*The shortest line that can be drawn between any two points is the straight line which joins them.*

The definition of a straight line given by Profs. Phillips and Fisher, therefore, embodies a statement capable of deduction from the geometrical axioms by a chain of logical reasoning, and as a definition, is on strictly scientific grounds, quite indefensible.

Upon examining Prof. Halsted's book, the definitions of which more closely conform to the Euclidean models, one naturally wonders why this demonstration, even more simple in plane than in spherical geometry, has been introduced only in connection with spherical geometry; and one is led to inquire at how early

a point the proposition of plane geometry could properly be introduced.

In attempting to establish between any two lines a relation of equality or inequality, we find ourselves compelled to start from the following principles: *The whole is greater than any of its parts; The whole is equal to the sum of all its parts; Lines which may be placed so as to coincide are equal.* Using these principles alone, it is evident that we cannot compare every two arbitrary lines in magnitude. In any such comparison we must be able to place one of the lines, or portions of it, in complete or partial coincidence with the other. No direct comparison can be instituted, for example, between a straight line and a line no part of which is straight. For the purposes of the proposition in question, therefore, it is necessary to make the distinct assumption, that *the magnitude of every line is comparable with the magnitude of every other line, and between these magnitudes there exists a relation either of equality or of inequality*; or else, what is better, to await the method of limits and the development, by means of it, of metrical ideas, not only for straight lines, but also for curves. Prof. Halsted, accordingly, in spite of his apparent lateness in introducing the proposition, is guilty of an error in theory. He has attempted to give a complete discussion of a proposition, and appears to believe that he has done so, when in reality assumptions additional to those previously made must be introduced before such a discussion can be undertaken.

It seems worth while to make these criticisms, because the two books above referred to are at other points remarkable for their scientific accuracy, and are of so high an order of excellence generally that the student may not readily appreciate the existence of such errors as occur.

THOMAS S. FISKE.

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##### 'A CURVE-TRACING TOP,' AND A CURIOUS OPTICAL ILLUSION.

EDITOR OF SCIENCE: If Prof. Barus will use a smoked glass for his curve-tracing top to spin on, he will get more beautiful tracings than with any lead pencil arrangement. Then let him flow it over with *thin* demar varnish, and